

PATENT ABSTRACTS OF JAPAN

(11)Publication number : 05-185425

(43)Date of publication of application : 27.07.1993

(51)Int.Cl.

B29B 7/86
B29B 13/02
C08L101/00
// B29K101:00

(21)Application number : 04-019573

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(22)Date of filing : 07.01.1992

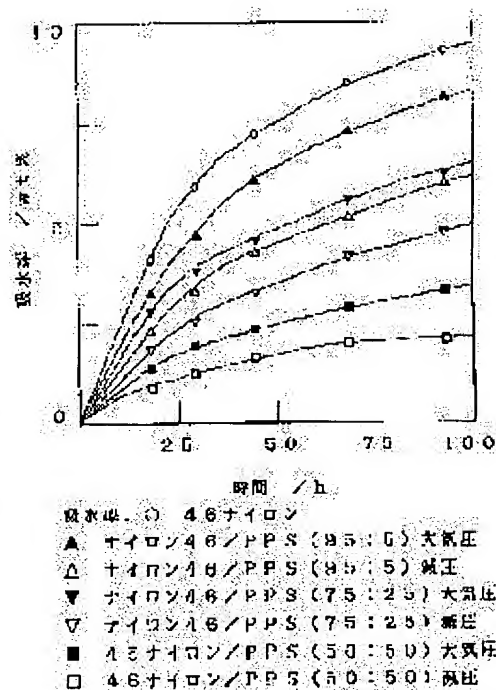
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(54) PRODUCTION OF POLYMER ALLOY

(57)Abstract:

PURPOSE: To produce a polymer alloy by uniformly kneading and mixing a different kind of polymers under reduced pressure in a molten state without adding a compatibilizing agent or other specific blend additives.

CONSTITUTION: A different kind of polymers are kneaded under reduced pressure of 300Torr or less. Since enthalpy becomes large and molecular motion becomes active, mixing becomes easy and the polymers can be uniformly mixed without using a compatibilizing agent and the damage of the characteristics of the mixed polymers due to the compounding of the compatibilizing agent is prevented. In such a case that the compatibilizing agent is contained, even when a block copolymer, a graft copolymer or a random copolymer is utilized and a polymer alloy is produced by generating chemical reaction at the time of kneading in a molten state, a stable phase state can be obtained and a uniform mixed state can be obtained.



LEGAL STATUS

Continuation of Attachment(s) 6). Other: English translations of JP 05-124090 and JP 05-185425.

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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CLAIMS

[Claim(s)]

[Claim 1] The manufacturing method of the polymer alloy which carries out melting kneading of two or more different-species macromolecule polymers during reduced pressure of 300 torrs or less.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[Industrial Application] This invention blends a giant-molecule polymer of a different kind, and relates to the manufacturing method of the polymer alloy as engineering plastics which have each property.

[Description of the Prior Art] For the improvement in the engine performance of polymeric materials, a polymer alloy is a blend or the alloy-ized thing, and two or more kinds of giant molecules are already used for the large application including the automobile or the electronic equipment ingredient. The property of a polymer alloy takes various gestalten until it results [from the homogeneity structure which it is greatly dependent on the phase condition, and shows compatibility] in micro ununiformity structure and macro ununiformity isolation construction. It is an important problem how stability is made to make form it and maintain the phase condition which becomes the functional manifestation of a polymer alloy from the homogeneity structure for which were suitable. However, since different-species macromolecules do not melt into homogeneity and homogeneity is influenced by the magnitude of thermal stress, in addition to mechanical kneading, approaches, such as a block, microfacies separation by graft copolymerization, formation of IPN (mutual permeation polymer network), use of a chemical reaction, and addition of a compatibilizer, are used for control of phase structure. Especially the approach using the block copolymer and graft copolymer which made different-species giant molecules join by covalent bond as a compatibilizer As an approach of raising the homogeneity of the different-species macromolecules which do not show each other compatibility, it is already known well. For example In a PS/PI system at a PS-PI block copolymer and a PS/PMMA system A PS/PMMA graft copolymer, In a PS/PE system at a PS-PE graft copolymer and a PA/PPO system An EGMA-PS graft copolymer, Various blend systems, such as a propylene-anhydrous maleate graft copolymer, are in nylon 6 / polypropylene system, different-species macromolecules are mixed by homogeneity in an operation of a compatibilizer, and all are having the new property which is not in each macromolecule discovered. However, although the compatibilizer was added, mechanical kneading is needed, if kneading stress is not enough, homogeneity will not be acquired and the target engine performance will not be discovered. Therefore, for example, blending with a header the macromolecule material which has specific macromolecule material and compatibility and has the property which complements the fault taking advantage of the property of specific macromolecule material, and blending it under specific conditions is indicated as shown in JP,63-205358,A, JP,1-174562,A, JP,1-182359,A, and JP,2-222449,A.

[Problem(s) to be Solved by the Invention] However, even if it blends the combination giant molecule excellent in this compatibility, it is difficult for the mixed condition to acquire the mixed state for the processing conditions limited extremely to be required and stable with sufficient repeatability. The purpose of this invention is to offer the approach of needing neither a compatibilizer nor other specific blend additives, but mixing a different-species macromolecule to homogeneity with a simple blend, and manufacturing a polymer alloy.

[Means for Solving the Problem] The manufacture approach of the polymer alloy by this invention is decompressing different-species macromolecules, and is characterized by carrying out melting kneading and cooling. If it is under reduced pressure and can fabricate by melting kneading as a macromolecule

polymer which can apply this invention, anythings are applicable, but it does not matter even if a polyamide, polyethylene, polypropylene, polystyrene, polyacetal, a polycarbonate, polyphenylene sulfide, a polyvinyl chloride, polyethylene terephthalate, etc. are mentioned and it, for example, mixes these two or more sorts. Furthermore, it is applicable also about the system which already added the 3rd component, such as a blend and an alloy-ized macromolecule system or a polymerization initiator, organic peroxide before bridge formation, and a bulking agent of an inorganic filler. In the temperature which the blended macromolecule fuses, it mixes with kneading equipments, such as a screw, within the well-closed container decompressed by 300 torrs or less. In order to acquire the good mixed state, decompressing to 1 torr or less is desirable. Different-species macromolecules are mixed by homogeneity in the condition of having decompressed, without being influenced by the rotational frequency of a screw. A uniform polymer alloy is obtained by cooling the sample which fully carried out melting kneading by the suitable approach.

[Function] Since this invention carries out melting kneading while decompressing a different-species macromolecule polymer, entropy becomes large and molecular motion becomes active, mixing becomes easy, and even if he has no compatibilizer, it can mix to homogeneity, and the property of each mixed macromolecule polymer by combination of a compatibilizer is not spoiled. Moreover, it becomes possible [if the approach of this invention is used when making a chemical reaction cause at the time of melting kneading when a compatibilizer is included and a block, a graft copolymer, and a random copolymer are used, and manufacturing a polymer alloy, it is possible to acquire a stable phase condition, and] to acquire the more uniform mixed state.

[Example]

Example 1 poly FANIREN sulfide (PPS) and Nylon 46 (PA46) were decompressed to 0.2 torrs within the container blended and sealed by 50:50, and melting kneading was fully carried out with the melting temperature of 320 degrees C. For the comparison, melting kneading was similarly carried out in atmospheric pressure. The kneaded sample was cooled underwater and the fracture surface was observed with the electron microscope. The result was shown in drawing 1 (kneading among atmospheric pressure), and drawing 2 (it kneads during reduced pressure). The following thing is clearer than drawing 1 and drawing 2 . That is, what carried out melting kneading in atmospheric pressure is not kneaded by homogeneity, but existence of a big and rough particle is accepted. To it, the shape of a particle does not have what carried out melting kneading in the 0.2-torr condition in the phase of the fracture surface, and it is mixed by homogeneity. In addition, what was decompressing and was kneaded is not dependent on cooling conditions, and the always uniform mixed state is acquired. next, the compounding ratio of PPS and PA46 -- 5:95 and 25: -- about what set to 75 and 50:50, was decompressing the inside of atmospheric pressure like the above-mentioned, and was kneaded, the test piece with a thickness of 3mm was created, it was immersed into 50-degree-C warm water, and change of water absorption was measured. The result is shown in drawing 3 . First, compared with what kneaded in atmospheric pressure what was decompressing and carried out melting kneading, water absorption is small. Moreover, if only PA46 is especially compared with PA46/PPS (95:5) reduced pressure kneading, water absorption is falling to about the abbreviation one half of PA46, and PA46/PPS (95:5) reduced pressure kneading can be judged that the absorptivity of PA46 has been improved considerably. These things show that the effectiveness of this invention approach has shown up effectively.

Example 2 polyphenylene sulfide (PPS) and Nylon 66 (PA66) were blended with 50:50, and the same experiment as an example 1 was conducted. Consequently, although it seems that the particle with what [big and rough in about one example] carried out melting kneading (drawing 4) in atmospheric pressure does not exist, but it is [compatibility-] easy toize PPS and Nylon 66, what carried out melting kneading (drawing 5) under reduced pressure of 0.2 torrs does not have a particle, and homogeneity is further mixed rather than melting kneading in atmospheric pressure. The measurement result of water absorption is shown in drawing 6 like [thing / of the compounding ratio 50:50 of PPS and PA66] an example 1. Although compatibility is comparatively good even if it kneads PPS and Nylon 66 in atmospheric pressure as shown in drawing 4 , compared with what was decompressing as shown in

drawing 6 , and carried out melting kneading, water absorption is large and the effectiveness of this invention approach understands it.

Example 3 polyphenylene oxide (PPO) and nylon 6 (PA6) were blended with 50:50, melting temperature was made into 300 degrees C, and the same experiment as an example 1 was conducted. The result was shown in drawing 7 (kneading among atmospheric pressure), and drawing 8 (it kneads during reduced pressure). As shown in drawing, the big and rough particle exists in what was kneaded in atmospheric pressure. Although a small particle exists also in what carried out melting kneading under reduced pressure of 0.2 torrs a little, it turns out that the particle is made detailed compared with that by which melting kneading was carried out in atmospheric pressure, and the effectiveness of this invention approach has shown up effectively.

Example 4 polycarbonate (PC) and nylon 6 (PA6) were blended with 50:50, melting temperature was made into 300 degrees C, and the same experiment as an example 1 was conducted. Consequently, a particle does not have in the fracture surface what what carried out melting kneading (drawing 9) in atmospheric pressure like the example 1 existed at the phase of the fracture surface, and carried out melting kneading (drawing 10) under the reduced pressure it is [reduced pressure] 0.2 torrs, and the particle-like phase is mixed by homogeneity.

[Effect of the Invention] The following effectiveness can be done so by this invention.

- (1) A uniform polymer alloy can be obtained, without being influenced by the class of macromolecule polymer to blend, and the blending ratio of coal.
- (2) Even if it does not use a compatibilizer, it becomes possible to manufacture easily the polymer alloy in which the macromolecule phase of a different kind carried out homogeneity mixing, or the polymer alloy which the particle distributed minutely.
- (3) Addition of not only the mixture of the conventional giant-molecule polymer but the compatibilizer as the 3rd component is possible, and it can apply to a block, a graft copolymer, a random copolymer, chemistry denaturation, etc.

[Translation done.]